

## CLAIMS:

1. A structural element comprising:

at least one pre-tensioned fibre reinforced plastic reinforcement member, the pre-tensioned fibre reinforced plastic reinforcement member  
5 having a constant cross-section through a length of the reinforcement; and  
a polymer concrete member surrounding said pre-tensioned fibre reinforced plastic reinforcement member;

wherein a force transfer between the fibre reinforced plastic reinforcement member and the polymer concrete is through polymer  
10 adhesive bonding.

2. The structural element of claim 1 wherein a ratio of a perimeter length of the pre-tensioned fibre reinforced plastic reinforcement member over the cross sectional area of the pre-tensioned fibre reinforced plastic reinforcement member is at least one-third larger than a ratio of a perimeter  
15 length over the cross sectional area of a circular bar having the same cross sectional area.

3. The structural element of claim 1 a ratio of a perimeter length of the pre-tensioned fibre reinforced plastic reinforcement member over the cross sectional area of the pre-tensioned fibre reinforced plastic reinforcement member is at least one-half larger a ratio of a perimeter length over the cross  
20 sectional area of a circular bar having the same cross sectional area.

4. The structural element of claim 1 wherein a ratio of a perimeter length of the pre-tensioned fibre reinforced plastic reinforcement member over the cross sectional area of the pre-tensioned fibre reinforced plastic reinforcement member is at least double a ratio of a perimeter length over  
25 the cross sectional area of a circular bar having the same cross sectional area.

5. The structural element of claim 1 wherein a ratio of a perimeter length of the pre-tensioned fibre reinforced plastic reinforcement member over the cross sectional area of the pre-tensioned fibre reinforced plastic reinforcement member is at least quadruple a ratio of a perimeter length over  
30 the cross sectional area of a circular bar having the same cross sectional

area.

6. The structural element of claim 1 wherein the fibre reinforced plastic reinforcement members is solid.

5 7. The structural element of claim 1 wherein the fibre reinforced plastic reinforcement member is hollow.

8. The structural element of claim 1 wherein a wall thickness of the reinforced plastic reinforcement member is between 1 and 5 mm.

10 9. The structural element of claim 1 wherein the structural element includes at least one non pre-tensioned fibre reinforced plastic reinforcement member.

10. The structural element of claim 1 wherein the force transfer between the fibre reinforced plastic reinforcement member and the polymer concrete is between 20 to 50% of the ultimate tensile strength of the reinforcement member.

15 11. The structural element of claim 1 wherein the pre-tensioned fibre reinforced plastic reinforcement members may be pultruded fibre reinforced plastic.

12. The structural elements of claim 1 wherein the fibre reinforced plastic reinforcement member has at least a single flat.

20 13. The structural element of claim 1 wherein fibre reinforced plastic reinforcement members are filled with standard concrete, polymer concrete or a filled resin system and a metal or fibre composite reinforcing bar.

25 14. The structural element of claim 13 wherein the hollow pultruded, pre-tensioned fibre reinforced plastic reinforcement members are filled after tensioning of the fibre reinforced plastic reinforcement members.

15. The structural element of claim 1 wherein the polymer concrete includes an amount of polymer resin, an amount of a light aggregate with a specific gravity less than that of the resin and an amount of a heavy aggregate with a specific gravity larger than that of the resin.

30 16. The structural element of claim 16 wherein the polymer resin used in the polymer concrete is polyester, vinylester, epoxy, phenolic or polyurethane resin or combination of resins.

17. The structural element of claim 15 wherein the resin content is between 25-30% by volume of the polymer concrete.

18. The structural element of claim 15 wherein the light aggregate has a specific gravity of between 0.5 to 0.9.

5 19. The structural element of claim 15 wherein the light aggregate content is between 20-25% by volume of the polymer concrete.

20. The structural element of claim 15 wherein the light aggregate is centre spheres.

10 21 The structural element of claim 15 wherein the heavy aggregate content is between 40-60% by volume of the polymer concrete.

22. The structural element of claim 15 wherein the heavy aggregate has a specific gravity of between 2 to 3.5

23. The structural element of claim 15 wherein the heavy aggregate is basalt.

15 24. The structural element of claim 15 wherein the resin contains a thixotrope to keep the light aggregate in suspension.

25. A method of producing a structural element formed from polymer concrete, said method including the steps of:

20 producing a mould that has a portion of an outer shape of the structural element to be produced;

placing fibre reinforced plastic members within the mould, tensioning at least one of the fibre reinforced plastic members;

locating polymer concrete over said fibre reinforced plastic members;

25 allowing said castable material to set to form said structural element; and

releasing said pre-tensioned members after the castable material has set to form said structural element.

30 26. The method of claim 25 wherein the fibre reinforced plastic members are abraded prior to the fibre reinforced plastic members being introduced into the mould.

27. The method of claim 25 wherein the fibre reinforced plastic members

are coated with sand and/or gravel interface prior to the fibre reinforced plastic members being introduced into the mould.

28. The method of claim 25 wherein the fibre reinforced plastic member is located within the mould, then tensioned and polymer concrete poured over  
5 the fibre reinforced plastic members.

29. The method of claim 25 wherein the fibre reinforced plastic member is located within the mould after sufficient polymer concrete to complete the structural element has been delivered into the mould and at least one of the fibre reinforced plastic members is tensioned before the polymer concrete  
10 sets.

30. The method of claim 25 wherein where the fibre reinforced plastic member is hollow, the hollow fibre reinforced plastic members is filled with concrete, polymer concrete or filled resin system and/or metal or reinforced plastic bar.

31. The method of claim 30 wherein the hollow fibre reinforced plastic members are filled after the tensioning has been removed and the polymer concrete has set.  
15